UM10793

SSL5031BDB1207 120 V 9 W buck converter

Rev. 1 — 20 October 2014 **User manual**

Document information

Info	Content
Keywords	SSL5031BDB1207, SSL5031BTS, non-dimmable, LED driver, buck converter, A19
Abstract	This user manual describes the operation of the SSL5031BDB1207 120 V 9 W non-dimmable LED driver featuring the SSL5031BTS. The demo board uses a buck topology. It has a form factor that is compatible with the base of a A19 LED lamp fitting used in Solid-State Lighting (SSL) applications.

Revision history

Rev	Date	Description
v.1	20141020	first issue

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1. Introduction

WARNING

Lethal voltage and fire ignition hazard

The non-insulated high voltages that are present when operating this product, constitute a risk of electric shock, personal injury, death and/or ignition of fire.

This product is intended for evaluation purposes only. It shall be operated in a designated test area by personnel qualified according to local requirements and labor laws to work with non-insulated mains voltages and high-voltage circuits. This product shall never be operated unattended.

This user manual describes the operation of the SSL5031BDB1207 120 V 9 W eco-THD non-dimmable LED driver featuring the SSL5031BTS. The reference board has a A19 LED lamp compatible form factor. The buck converter topology provides a simple and efficient solution for mains non-dimmable LED recessed light applications.

The reference board complies with EMI and safety regulations.

Figure 2 shows the dimensions of the SSL5031BDB1207 demo board. The design of the board allows enough headroom for the board to fit into a A19 lamp base.

Figure 3 shows the SSL5031BDB1207 assembled top and bottom views.

2. Safety warning

The demo board input is connected to the 120 V mains supply. Avoid touching the board while it is connected to the mains voltage and when it is in operation. An isolated housing is obligatory when used in uncontrolled, non-laboratory environments. Galvanic isolation from the mains phase using a fixed or variable transformer is always recommended. Figure 1 shows the symbols on how to recognize these devices.

a. Isolated

b. Not isolated

Fig 1. Isolation symbols

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3. Specifications

Table 1 lists the specification of the SSL5031BDB1207 demo board.

Table 1. SSL5031BDB1207 specifications

Symbol	Parameter	Value
V_{mains}	AC mains supply voltage	120 V (AC); ±10 %
I_{mains}	AC mains input current	80 mA
V_{LED}	output voltage	40 V
I_{LED}	output current	205 mA
$I_{LED(ripple)}$	output current ripple	< 30 %
$\Delta I_{LED}/\Delta V_{mains}$	line rejection	< 2 %
$\Delta I_{LED}/\Delta V_{LED}$	output voltage rejection	< 1 %
η	efficiency	> 88 %; at 120 V (AC)/60 Hz
PF	power factor	> 0.95
THD	total harmonic distortion	< 20 %
T_{oper}	operating temperature	−40 °C to +100 °C
f_{sw}	switching frequency	60 kHz to 160 kHz
$t_{startup}$	start-up time	120 ms

Figure 2 shows the dimensions of the demo board.

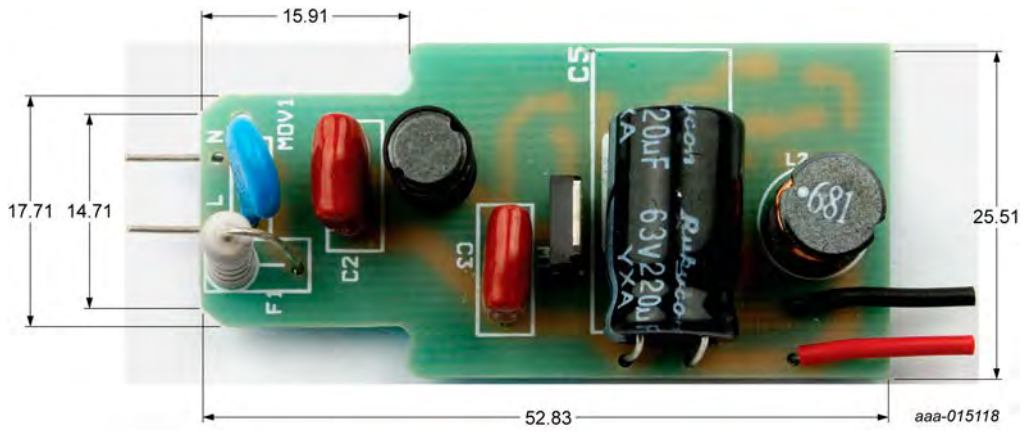

Fig 2. SSL5031BDB1207 demo board dimensions

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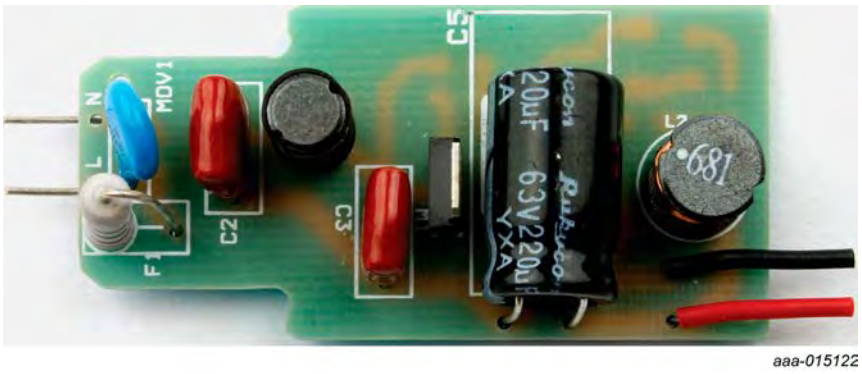
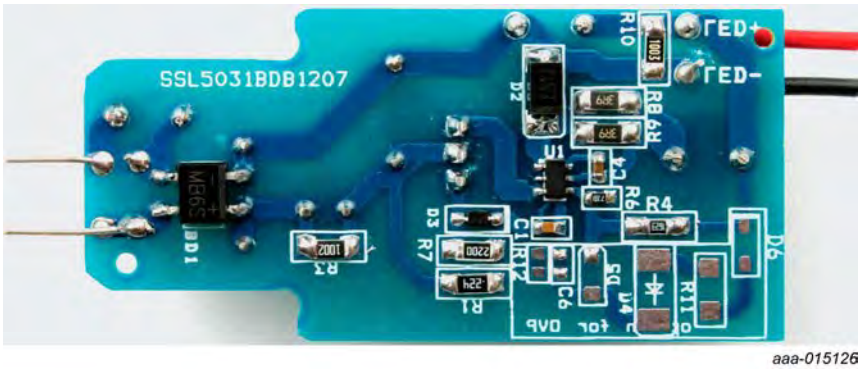
4. Board photographs



a. Top view



b. Bottom view

Fig 3. SSL5031BDB1207 demo board

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5. Board connections

The SSL5031BDB1207 demo board is optimized for a 120 V (AC)/60 Hz supply. It is designed to work with multiple LEDs or an LED module.

Remark: The maximum rated voltage of the board is 132 V (AC).

The anode of the LED load is connected to LED+. The cathode is connected to LED-. Use an LED string with a forward voltage up to 40 V on this reference board. Under the expected conditions, the output current is 205 mA.

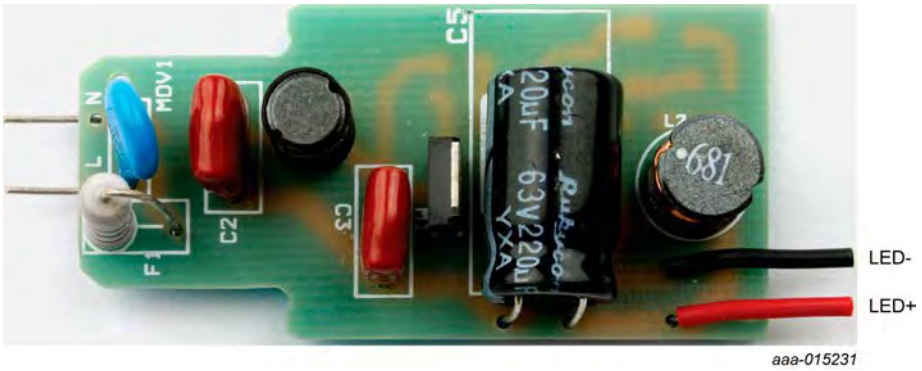

Fig 4. SSL5031BDB1207 board connections

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6. Performance

The performance was measured with a 40 V at an LED output load of 205 mA. Figure 5 to Figure 10 show the performance data.

6.1 Efficiency

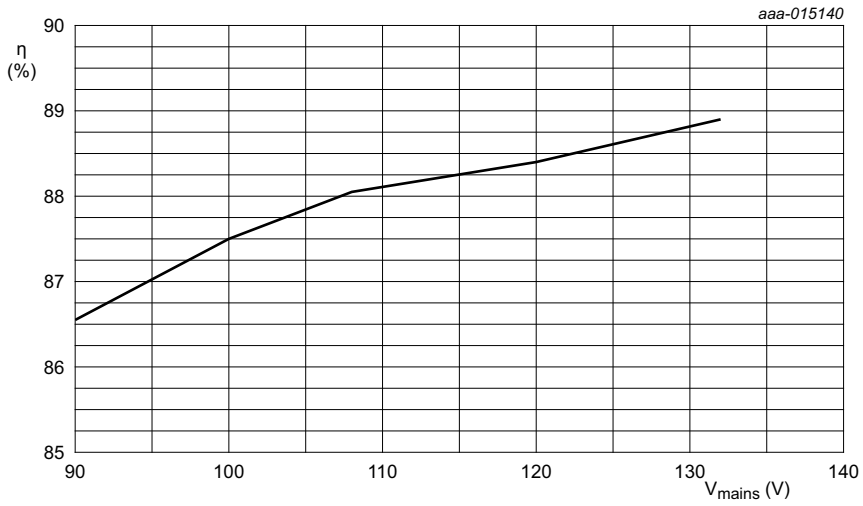

Fig 5. Efficiency as a function of mains voltage

6.2 Power Factor (PF)

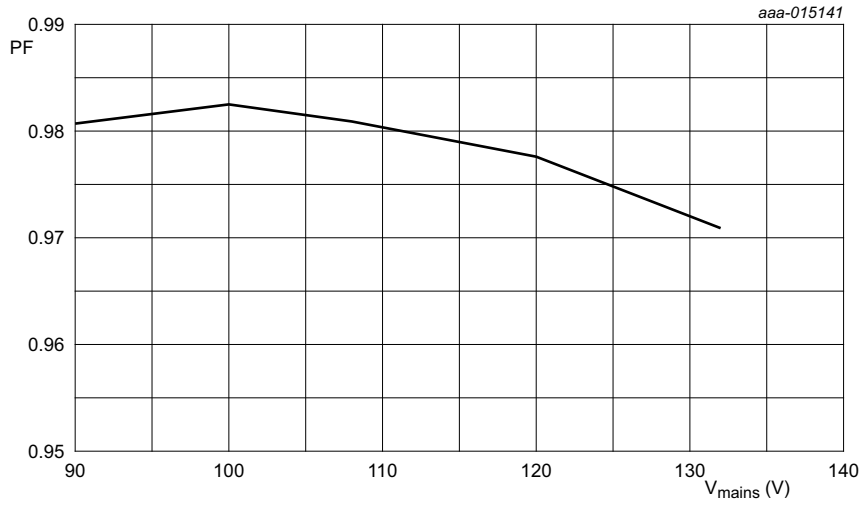

Fig 6. PF as a function of mains voltage

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6.3 Line regulation

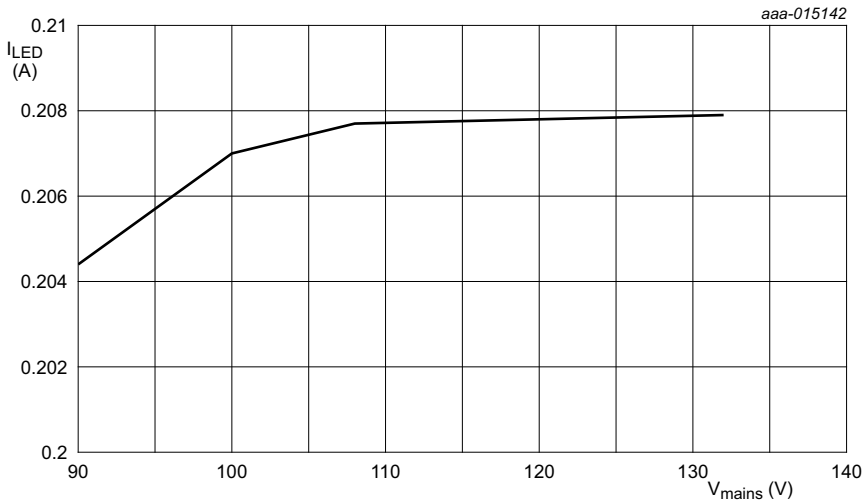

Fig 7. LED current as a function of mains voltage

6.4 Load regulation

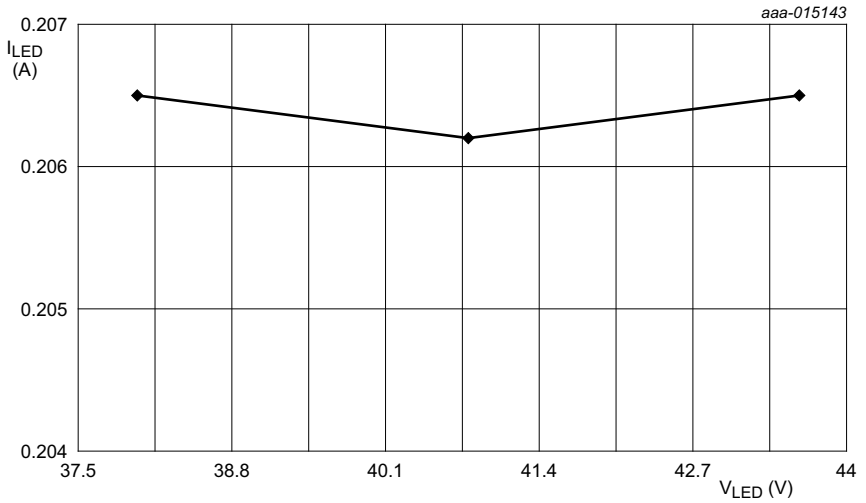

Fig 8. LED current as a function of LED voltage

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6.5 Total Harmonic Distortion (THD)

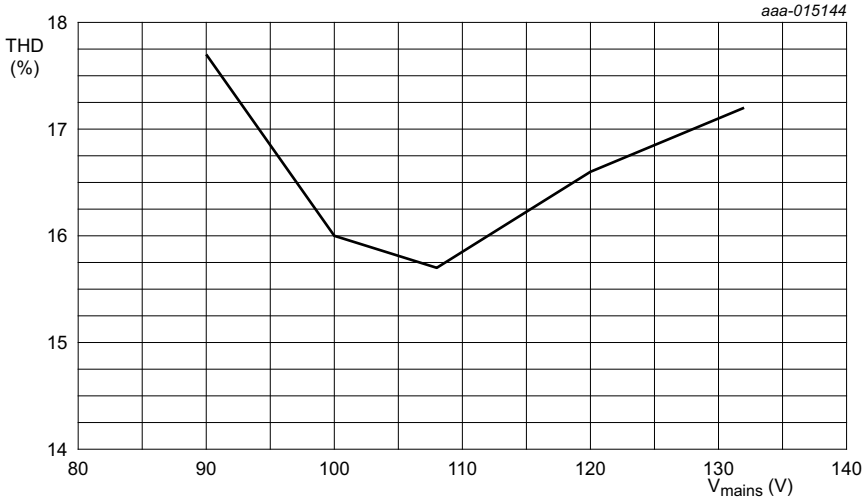

Fig 9. THD as a function of AC mains input voltage

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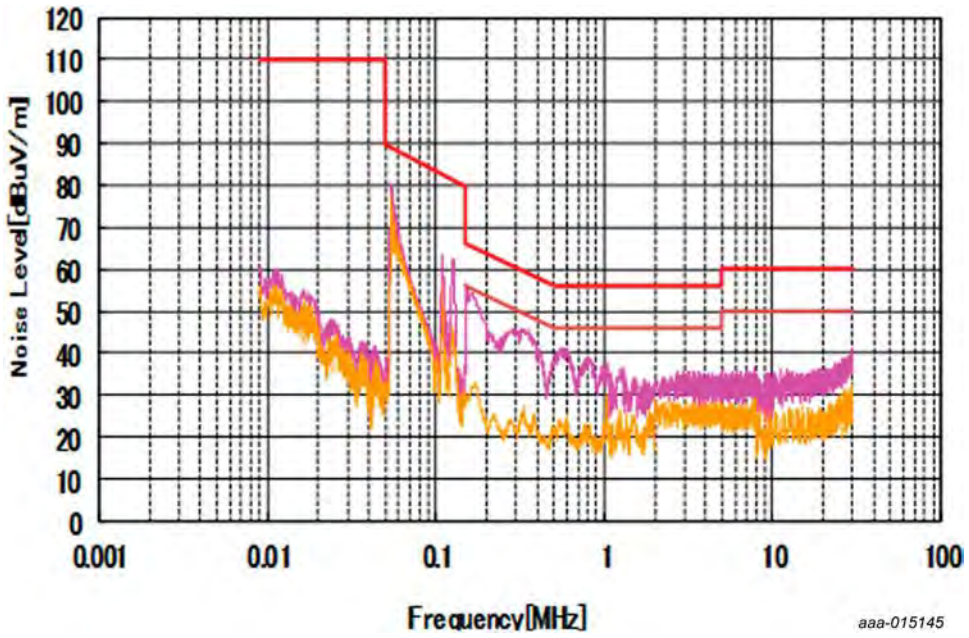
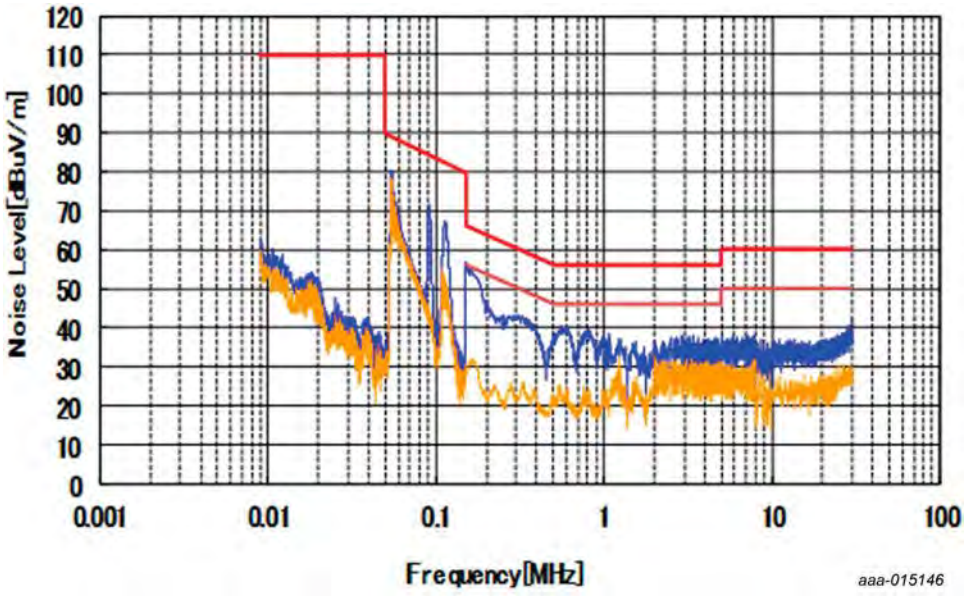
6.6 ElectroMagnetic Interference (EMI)

Figure 10 shows the EMI performance. The board complies with the EN55015 standard requirements.



a. AC mains - Line



b. AC mains - Neutral

Fig 10. SSL5031BDB1207 demo board conduction performance

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7. Protections

The IC incorporates the following protections:

- UnderVoltage LockOut (UVLO)
- OverCurrent Protection (OCP)
- Output Short Protection (OSP)
- Output open OverVoltage Protection (OVP)
- Internal OverTemperature Protection (OTP)
- External thermal foldback (optional)

All protections are not latched and lead to a safe restart of the converter. For more information about protections, see the *SSL5031BTS data sheet* (Ref. 1).

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8. Schematic

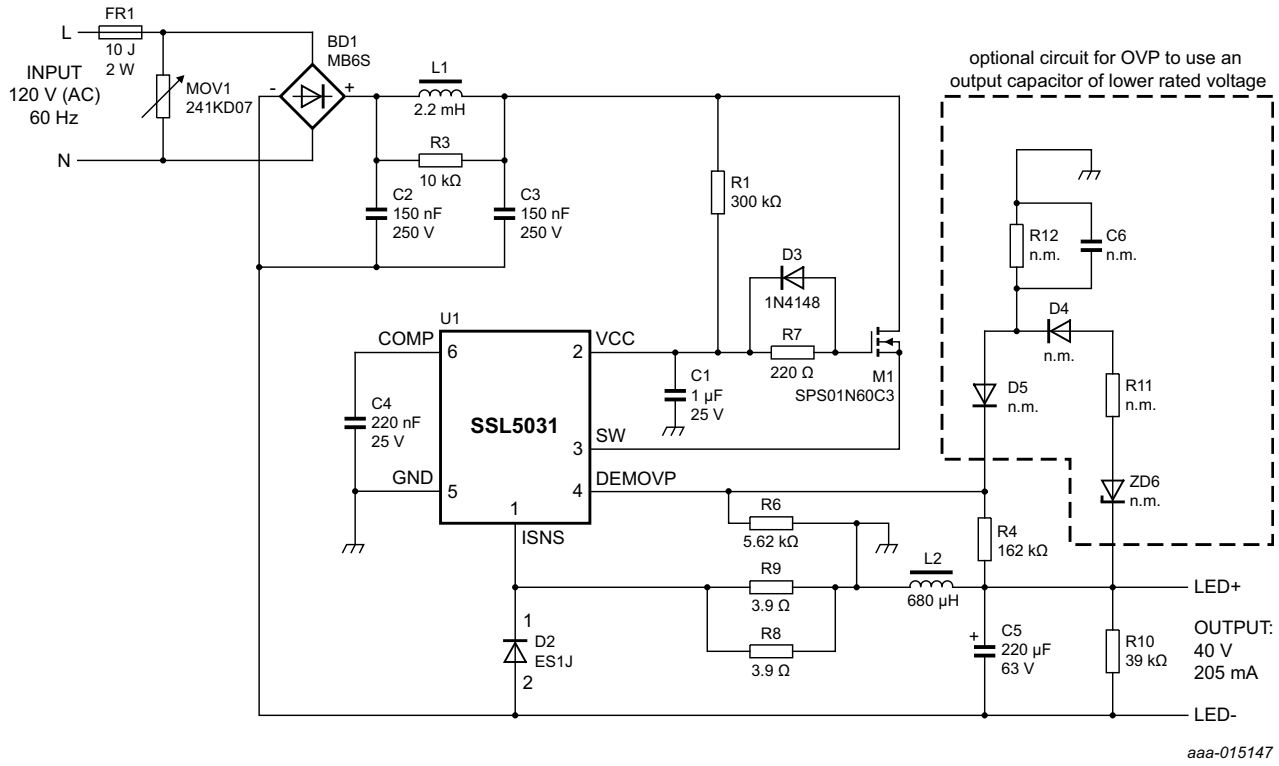

Fig 11. SSL5031BDB1207 schematic diagram

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9. Bill Of Materials (BOM)

Table 2. SSL5031BDB1207 bill of materials

Reference	Description and values	Part number	Manufacturer
BD1	bridge rectifier; 600 V; 500 mA; MBS-1	MB6S	MCC
C1	capacitor; 1 μF; 25 V; 0603	GRM188R71E105KA12D	Murata
C2; C3	capacitor; film; 150 nF; 250 V; CL21; pitch = 7.5 mm	-	-
C4	capacitor; 220 nF; 25 V; 0603	GRM188R71E224KA88D	Murata
C5	capacitor; 220 μF; 63 V; pitch = 5 mm; 10 mm × 16 mm	OLKE21J221MF	Shanghai Yongming Electronics
C6	capacitor; not mounted	-	-
D2	diode; ultrafast; 600 V; 1 A; SMA	ES1J	Taiwan Semiconductor
D3	diode; ultrafast; 75 V; 150 mA; SOD323	1N4148	DiodesZetex
D4; D5	diode; not mounted	-	-
FR1	fuse resistor; 10 Ω; 2 W; 5 %	RF10-2W10J	TY-OHM
L1	inductor; 2.2 mH; I_{sat} = 0.16 A; pitch = 3 mm; 6 mm × 8 mm	DR0608-222 A	KEE
L2	inductor; 680 μH; I_{sat} = 0.6 A; pitch = 5 mm; 8 mm × 10 mm	744 772 681	Würth Elektronik
M1	MOSFET; R_{DSon} = 6 Ω; I_d = 0.8 A; V_{ds} = 650 V; TO-251	SPS01N60C3	Infineon
MOV1	varistor; 150 V (AC); 200 V (DC); ∅ = 7 mm	241KD07	BrightKing
R1	resistor; 300 kΩ; 5 %; 1206	-	-
R3	resistor; 10 kΩ; 5 %; 1206	-	-
R4	resistor; 162 kΩ; 1 %; 1206	-	-
R6	resistor; 5.62 kΩ; 1 %; 0603	-	-
R7	resistor; 220 Ω; 5 %; 1206	-	-
R8; R9	resistor; 3.9 Ω; 1 %; 1206	-	-
R10	resistor; 39 kΩ; 5 %; 1206	-	-
R11; R12	resistor; not mounted	-	-
U1	controller; TSOP6	SSL5031BTS	NXP Semiconductors
ZD6	diode; Zener; not mounted	-	-

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10. Board layout

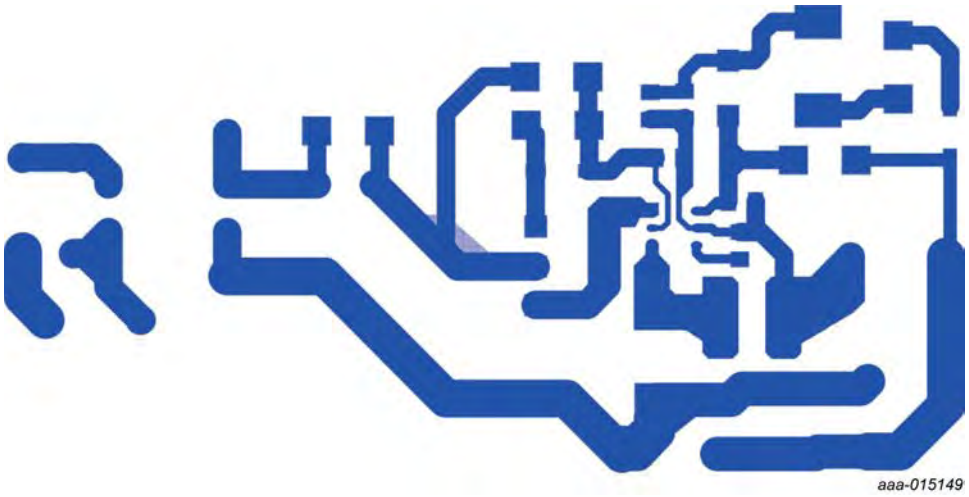

Fig 12. SSL5031BDB1207 demo board assembly, bottom view

11. Abbreviations

Table 3. Abbreviations

Acronym	Description
EMI	ElectroMagnetic Interference
LED	Light-Emitting Diode
OCP	OverCurrent Protection
OSP	Output Short Protection
OTP	OverTemperature Protection
OVP	OverVoltage Protection
PF	Power Factor
SSL	Solid-State Lighting
THD	Total Harmonic Distortion
UVLO	UnderVoltage LockOut

12. References

[1] **SSL5031BTS data sheet —** Compact high power factor/low-THD buck LED driver IC

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